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Economy in study--certain
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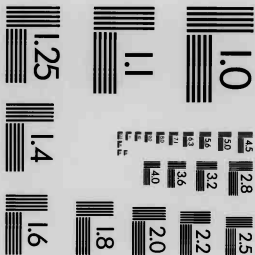
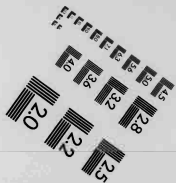
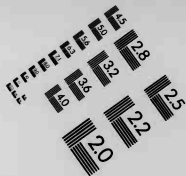
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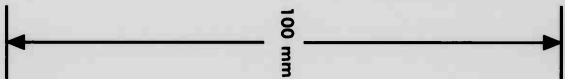
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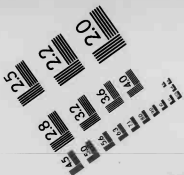
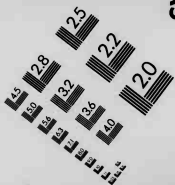
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ECONOMY IN STUDY:

CERTAIN PRACTICAL POINTS, PSYCHOLOGICAL AND
PHYSIOLOGICAL, ON HOW TO STUDY TO THE
BEST ADVANTAGE.*

BY GEORGE VAN NESS DEARBORN, M.D.,

CAMBRIDGE, MASS.

PROFESSOR OF PHYSIOLOGY; AND OF THE PHILOSOPHY OF
PHYSICAL EDUCATION IN THE SARGENT SCHOOL.

THE fact must be frankly faced that it is possible that some two or three of you would be more useful to yourselves and to the world in a nice "job," either on the front or on the back end of the street cars; or in a good, substantial position in a machine-shop, in a laundry, or in a confectionery store, or something like that. For it is possible, if not probable, that some of you are not of a scholarly "make-up" at all, so that you never could be a success as physicians. Now is the time to discover it, although a year at anatomy and physiology would in any event be of use to you.

Interest in the Subject.—If you are naturally of a scholarly disposition it is much easier to effectively study than otherwise it could be. But whether scholarly or not you must first have a real interest

*Remarks made, for the most part, to the Premedical Class of the Tufts College Medical School, Boston, March 8, 1915.

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in that which you wish to study. If you have grown up without the "natural medical interest," it is your duty to acquire an interest in Medicine, but when you have really acquired a real *interest* you will learn almost reflexly and without any great effort on your part because it will be a *pleasure* to you. So this matter is truly worth while. Furthermore, you must have a continually changing and a continually developing interest, not only in Medicine as a whole, as a prospective life-profession, but interest in each of the forty and more subjects as they come along. Some of the essential medical subjects will be most interesting to you and some of them certainly least interesting, but in every case, if you wish to economize and if you want to adequately learn, you will, as a preliminary, develop an interest in the subject you are studying. It was once facetiously claimed by Huxley that he could make a course in osteology interesting to anybody who studied it! It is absolutely necessary, then, in short, to have *interest*, natural or acquired, and if you have not a natural interest you will have to acquire one, or obtain some other form for your continual use!

Some, in fact millions, never go far enough or deep enough to develop an interest—never deep enough to realize how unimaginably marvellous is their world of matter and life and mind. This may be "fate" or it may be just laziness.

The best way to develop an interest in any subject is by *collateral reading*. Read broadly on subjects allied more or less closely to what you are studying. When it is physiology, for example, you should read about related diseases, physics, psychology, and the enticing histology of the nervous system, for examples. There are all sorts of exceed-

ingly interesting material to be got from the libraries which is related to this particular subject, complex and fascinating itself. Another way to develop interest is by *thinking* for yourself of those relations. A third method is to *associate with people* who already have an interest. Fortunate is the student who can have the advantage of association with masters of the subject then in hand. Whatever be the means, you must have interest—by this time you ought to believe this fundamental fact, if reiteration will make you!

Whatever you have an interest in, you *enjoy* doing, and that is the reason why well-adapted work in the long run is the most certain, if not the greatest, of human delights. Many people think of work as a necessary something disagreeable rather than agreeable, but I repeat that it is certainly one of life's most permanent and substantial satisfactions and delights. Unpleasant undeniably is work that is not adapted to the individual. You do not often see professors in our universities and colleges grumbling about their work, and this is not primarily because their work on the whole is pleasant, but more often because it is well adapted to them; for else they give it up. It is the vast body of men who do not as yet have work which is adapted to them who do not like to work. All great, useful, and original work ordinarily is done under conditions such that the work is enjoyable, there being always enough of interest about it to make it pleasurable. It is under these conditions, furthermore, and generally under these alone, that the largest amount of energy is expended. This basal relationship is expressed in the science of efficiency in the term "Sthen-euphoric Index," meaning, in short, the more or less direct ratio between the expenditure of *en-*

ergy in any action and its inherent *pleasantness*. "Enjoy your work and you will most likely expend a very large amount of energy in it." This is the practical corollary of this fundamental index of organic dynamics.

After having a good interest acquired and understood the relations between it, enjoyment, initiative, and energy, we may next consider the learning process proper. There are two kinds of learning as a procedure, one of which is a *conscious* process, conscious, deliberate study; while the second is another mode of learning, of which most of you are not even aware, namely, *subconscious* learning; in short, by observation and association, more or less unconscious.

Conscious or Deliberate Study.—When you think of study most of you, I am sure, consider only conscious, deliberate study, reading, or "grinding" usually in some book or other. This process, as you will understand next year better, is essentially a checking or restraining process, that which we call in physiology and in psychology "inhibition," an incentive of some sort to check some active process by a normal influence. The process of conscious study is one of an inhibitory nature—in its ultimate analysis the essence of humanity and of its civilization and culture—this year so horribly abused!

In the first place you have to inhibit *fatigue*, when you "grind." You are tired and would like to go to bed, or to go outside for a walk, or to some place of amusement that is restful. There should be no fatigue, theoretically. Your work should be so arranged, alternating with rest and exercise and eating, that there should be no appreciable and depressing fatigue. This inhibition of which we are speaking seeks a more *pleasant occupation*. Billy calls

around and wishes you to play "old maid" or something or other; or Cousin Susie wants you to go to the movies with her. Then there are many *distractions* which have to be inhibited: the reckless automobiles or carting on the avenue, cats or hyenas on the back fence, a piano-torture from the next room, or someone beyond all humanity trying to play on the violin. All sorts of *sensory stimuli* have to be kept out of your effective mind. The *desire to change* must be inhibited, the perfectly normal tendency to change your occupation and thus get rested.

Study, then, so far as deliberate, is the forcing of the mental processes along new pathways, the forcing of nerve-impulses perhaps through groups of thousands of neurones where exactly they have not been before. When interest is acquired and other things are right and you are in good physiological condition, it is a real pleasure to truly grind. The habit of even this kind of study is easily acquired, much more easily in most of you than you think. Even the habit of inhibitory, forceful grinding on difficult study-subjects is soon acquired if you give yourself a fair chance to acquire it; and knowledge and understanding will represent the comfort of your wives and children for they will largely be your earning capital.

Beware of *false study*, dozing: trying to hold your eyes open while your brain is shut tight. In such cases your brains are not open, for the sensory paths and the association paths are closed. If your interest or attention cannot be forced on what you are studying, you should wholly rest for a few minutes or else open the windows, stir about, and force the issue! Or, if conditions are such that you cannot possibly give your attention to your subject, as

in fatigue readily may happen, give it up. Unless you give your whole attention to whatever you are studying it is of little or of no account to you, and much worse than that, it gets you into the bad habit of sitting with a book in front of you and pretending to yourself (and sometimes to your teachers) that you are studying when in reality your brain-neurons are not getting hold on the facts at all. The loss of a little time is of no account compared with the misfortune of this habit.

There should be *no rote-learning*. There are only extremely few things that are properly learned by rote, and it is well to avoid attempting to learn in this way. In the long run it is a great waste, and therefore I suggest that you do not get into this habit either. No lecturer or quiz-master who knows his pedagogical business will give out his material or opinions so that you can take it down in the form of formulæ and "run it in" on an examination or elsewhere. A lecture should be, almost always, explanation and not description; lectures are properly complementary to texts. Facts and principles should be learned by concept, not by word.

There are certain physiological requisites for study, especially five things of a hygienic physiological nature which must be mentioned: namely (1) good health, (2) abundant outdoor muscular exercise, (3) abundant natural air, (4) abundant proper food, and (5) abundant sleep.

It is necessary for a student to have *good health*, else he is inexcusably wasteful. One cannot possibly study, for example, with *eye-strain*, for this inflicts a continuous strain on the brain and on the whole nervous system, which depresses the vigor of the mental action. Students should not think of studying when they have a *headache*, in which condi-

tion the brain is congested with blood. Under such circumstances it would be more economical to take a brisk, erect, longish walk out of doors, or to do almost anything except study. For a like reason, one should not try to study when he is *ill*, say with a bad cold in the head, even a mild influenza, or anything of that sort. Some try to study when they are at home "sick," which is absurd, unless it is a broken leg or something of that non-neural nature. It is very necessary that a successful student should be *free from worry*.* Don't stay a student and allow yourself to worry about the family skeleton, illness in the home, or other things even though they be of such real importance. If worrying interferes with your business of studying, either give up worrying or postpone your business, for certainly you cannot do both at the same time. In some cases study can be made to force the worry out of your head; if so, it is well.

Take *abundant gross muscular exercise*. The reason for this is that exercise stimulates the circulation, and "keeps the cobwebs out of the brain," the spinal cord, and other important nerve-masses. Muscles, as well as brains, are used in thinking, and they don't work as well when they are flabby and out of tone, and poorly supplied with oxygen and clogged with carbon dioxide. Too much exercise, on the other hand, must be avoided, since it employs the brain and so tires it beyond use for study.

Abundant Natural Outdoor Air.—It is not necessary to study out of doors, as you can have plenty of outdoor air indoors by the simple expedient of opening the windows. Air of the proper tempera-

*See, for the therapeutics of worry and nerve-waste in general, a little monograph called "Nerve-Waste," Health Education League Booklet, No. 27, Boston, 1912.

ture and proper humidity is essential. Moving air, properly moist and properly cool (68° F.), is the ideal.†

Have *abundant food*, but not too much. The ideal is food that is easily digestible and taken often. Four moderate meals a day is far better for a student than two over-large. Coffee may be taken if necessary for successful study. There are many authors who do good and abundant creative work under the influence in general only of tea or of coffee, essentially alike in their stimulant action. I do not suggest alcohol, for it is a poisonous depressant and not a stimulant at all, save indirectly on the heart.

Students to be efficient must have *abundant sleep*. Ten hours is little too much. There must be no study within an hour, at least, after eating. Gentle ambulatory exercise helps digestion, on the other hand. It is certain that if the blood is in the stomach doing its work there, enough of it cannot be at the same time in the brain, and your brain cannot work without its normal abundance of blood. So that it is quite absurd to think of studying to good advantage immediately after a hearty meal. It is by many considered a good thing at times through the day to take cat-naps. Food digests best of all when you are asleep. Do not try to carry on your work on the boa constrictor plan of taking one big meal every six months and then going to sleep for the next six months! The boa constrictor is a poor student. Ten hours sleep is none too much and cat-naps certainly are excellent, for a short

†For a discussion of the need of moving air and of other hygienic conditions, see the lecturer's "Certain Further Factors in the Physiology of Euphoria," *Psychological Review*, XXI, 3, May, 1914, 166-188, illustrated.

nap, even of five or ten minutes, gives one a large amount of cerebral rest, for even a five-minute nap takes the blood for a moment out of the brain, stirs things up there generally, and makes one ready for a good siege of study.

Attention to a book should *not* be *too long concentrated*, without pause. It should by habit be concentrated vigorously, but only for relatively short periods at a time. There should be more power of concentration for short periods than most high-schools inculcate, but one cannot keep his mind strongly concentrated for long periods under ordinary degree of educational interest. Every twenty minutes or so you should walk around the room for a minute or two, for this activity draws some of the blood out of your brains into your legs; moreover, it relieves the injurious long fixation of the eyes. No one can sit for an hour, or an hour and a half, without changing his position, except at a considerable loss of nerve-economy, and it is under such a condition naturally difficult to avoid going to sleep, partial or complete.

Grammar schools and high schools almost never as yet succeed in teaching their students *how to think*, and yet that is what counts most. A momentary, thoughtful idea often is worth a week of fruitless mechanical grind, just as one large highly-cultivated Gravenstein is worth a whole barrel of crab-apples. Quality not quantity is what counts in study as well as in other things. Make a serious business of it, then, when you study, remembering that real learning, that is understanding and constructive power, comes only through thought.

Subconscious Learning.—This is a mode of learning which one unfamiliar with psychology is not apt to think of as "study" at all. You require this kind

of learning (both as process and as product) with your subconscious minds, physiologically chiefly, the association of millions of neurones. Subconscious observation by your subconscious minds would be a common way to characterize it.

A good example of this kind of study or learning is a child about two years old learning to speak. The child, of course, does not at first consciously strive to pick up the marvellous art of speaking, but none the less he acquires it quickly, in part by imitation. You cannot understand anything worth learning without this factor of mind, the subconscious mind, the great integrator of intelligence. The endless details of knowledge are supplied very largely by this unconscious mental process, this continual subconscious perception and observation by all the senses at once.

It is beyond our present range to describe this phase of the human mind, that deep and on-rushing part of "the stream of consciousness," which is closest to the nervous integrators of protoplasmic function. It is the great planner of our behavior, however, the chief solver of our most important problems in the conduct of life; it is the seat of our motives, the developer of our habits, the associator of our ideas into real and useful knowledge. I recommend it to you for study, that you may understand your own self and the minds of those about you, your future patients especially. (Von Hartmann, Dubois, H. Poincaré, Morton Prince, Ribot, Janet, will teach you about it, all that you need to know, until you observe its phenomena first hand for yourselves.)

At present we are concerned with the subconscious as the chief active recipient of information from the environment and as the chief arranger,

developer, and increaser of this ever-varying multitude of educational impressions. As has been said already, without the subconscious there could be no real understanding of actual conditions of experience at all, so myriad are they and so complex and interinvolved.

Keep all your senses open, therefore, to "light" of every kind imaginable which the subconscious integrating process may relate to each other and to yourself, and make you truly *wise*.

There are three chief ways of studying in this process of collegiate learning. In the first place, by more or less conscious *seeing* and observing of books, diagrams, pictures, and other things that you can get only through your sense of vision. Second, *hearing* things with your ears, such as lectures, recitations, and talk. And third, by actually actively *doing* things—extensive laboratory work, clinical work, and to a much less extent essay-work, constructive drawing, research. To discuss these within the hour is out of the question, so that we must be content with the mere observation, although of basal and vast importance, that *doing*, as opposed to receiving, represents the modern method of learning even the most abstract of subjects. The world is becoming aware, and effectively aware, that bodily efficiency one way or another is the basis of learning, or, in the words of wise old Pestalozzi, "Keine Kenntnisse ohne Fertigkeiten!"—that is, No knowledge without skill.

Imagination is essential in every scientific man who is more than a manikin. But *visualizing imagination* is of immediate necessity to every student and especially to the student of any individual branch of biology. You must be able to look, in your minds, directly into

any part of a living organism and accurately see just what there is and precisely what is going on there. The lack of this power, I am convinced, is the cause of the inefficiency of many physicians. Anatomy, histology, physiology, pathology, clinical surgery, clinical medicine are but impractical knowledge without this faculty, easily developed (by most students) by a little practice. I recommend it to you as an important accomplishment as well as a valuable means of study.

The taking of notes is of sufficient importance practically to warrant a few minutes of discussion. If textbooks are the meat of the student, his notes are certainly his necessary drink, with his meals and at other times. It has been said that one "should train their powers of observation and memory" so as to be able to go into a lecture room and get the gist of the lecture without taking notes. But in the first place, we cannot develop our memory.* Born with a certain kind and perfection of memory we cannot increase its effective span. Do not attempt to accustom yourselves to this, for not one per cent. of you would succeed rather than fail. Every lecture in a professional school contains many material facts, and sometimes hundreds of them. and there is no mind that can remember them all *economically*. No matter how vital and permanent they may seem the moment when you hear them. they probably are soon replaced with others equally interesting, and very soon most of them are gone. many of them for good, while part of those which remain are jumbled and mistaken.

*For an up-to-date brief account of memory see the article in a leading medical encyclopedia, the "*Reference Handbook of the Medical Sciences*," third edition, volume six.

Take notes of everything worth noting. No matter where you are, whenever you hear anything, or even see anything worth noting, "make a note of it." These notes will be of value to you all your life, the most vital links of your mind with your precious college life; and often of great practical use.

Notes should be schematically arranged in a psychologically scientific way, with center headings, side headings, group headings, and subgroup headings, and put down according to *ideas* under such headings. When all run together notes are not of much use. Let a book's elaborate analytical table of contents be a model for this. One should get into the habit of using abbreviations. Shorthand is very desirable, economical, and almost necessary, but if you cannot manage to learn shorthand,† acquire a system of abbreviation of your device. Do not expect, as I have said already, to get from a lecture anything that you can take down and run in verbatim on an examination, for a good lecture is an explanation, not dictation, not a description, and not a set of crib notes.

It is extremely important to economy that you should keep your notes "posted up" every day, not only in your notebooks, but in your brains. Go over your notes in general every night and connect them with what has gone before, and so keep your mind up with the subject. *Examinations will take care of themselves* if you keep your didactic material posted up day after day. Examinations are not intended to trap you, but are intended as means to find out how much you know or do not know; mostly, in fact,

†For the stenography, etc., of this lecture I am indebted to Mr. Ernest Moore Gould, of the Dental Freshman class.

how much you do *not* know. Cramming for an examination is like carrying weights in your pockets when getting weighed: you are cheating yourselves. The economical way is to keep your notes posted up in your books and in your brains every day; so, they can associate and you learn much faster, giving your subconscious faculties a better chance. The power of grasping *ideas* is an extremely valuable one. Pick out the gist and sense of a running discourse, select the ideas and express them in your own words.

The drawing and writing of diagrams is of the greatest importance, and all put before you should be quickly sketched. The drawing of original diagrams is of much value to you, but the quick copying of those put before you is also very important. Things should not "go in one ear and out the other": there should be something within, between, them to fix the ideas, namely, your brains, and one easy way to do that is writing tersely the ideas, and drawing the diagrams whenever possible. You should, as has been said, learn to visualize, to see things in your mind, and this selection of the essentials will help this important habit.

Frequent reviewing is of the greatest importance. It tends to integrate things, keeps subjects unified, and puts the whole subject before you at once; without a wholeness nothing is of much account.

You should have *as large a variety of textbooks* as you can possibly afford on every subject you study, for, in that way, you get different points of view of the same topic and fixation is more certain. Every ten dollars paid for good books while you are a student will be worth a hundred dollars to you later on. And no wise person sells his old textbooks, for each one has associations with his mind which

make it often far more valuable and convenient to him in later years than a new one could be.

Conversation and discussion among yourselves are extremely important as means to accurate and broad information. Talk things over. Collateral reading always lends interest, and makes you a better talker, which in itself is well worth while in a professional man or woman.

Finally, I will suggest that it is a great waste for you to live out of town so that you are obliged to ride for more than half an hour twice daily in the train or street cars. If you figure up this time at the lowest valuation you will find it is actually economical to live near the college, even if your parents furnish living at home. Considering all matters, cash, nerve wear-and-tear, danger, eye-strain, etc., is is certainly economy to live in town and pay board and lodging rather than at home if it be more than, say, twenty miles away. This, like the other matters I have so inadequately suggested to you during the hour, I personally think are worth considering. For the race is keen.

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